Space Weather Technical Forecast

Issued on Tuesday, 29 August 2023 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of isolated M-flares (R1-R2 Blackouts) continues. Glancing CME arrival possible Day 2 (30 Aug) with slight chance of G1/Minor Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with only a minor C-flare in the past 24 hours. There are five sunspot regions on the visible disc. Two of these are small and simple. Of the three main sunspot groups of interest AR3415, in the south central area, remains the most complex with a persistent delta spot configuration, but has remained largely inactive. The larger AR3413 rotating to the west of centre disk has continued to see small amounts of development to its multiple leading spots and continues to retains a north-south magnetic alignment. The new region in the far east, now numbered AR3417, has been preliminarily re-classified as a Cso/Beta, though given the positions rounding the limb any classification is low confidence, and more complexity may be revelled as it rotates further into view.

No new Earth directed CMEs have been seen in available imagery over the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE/DSCOVR at L1, have been at persisting at background levels around 320-340km/s. Density was mostly average or just below. The interplanetary magnetic field, Bt, was primarily weak around 6nT, but with some enhancement from around 28/1700 UTC towards moderate levels of 8nT. The north-south component, Bz, has been mainly negative (southward directed), varying weakly between +4/-6 nT, but became solidly positive from 28/1700 UTC to a peak of +7nT. Phi angle was predominantly positive (away from the Sun), but became negative (towards the sun) from 28/1700 UTC. Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at background levels. GOES16 high energy (greater than 2MeV) electron flux was mostly at background levels. The associated 24-hour fluence was well below Active on a fairly steady trend, with 5.47e6 integrated pfu observed at 29/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: The current Low solar activity is expected to generally continue during the forecast period, but there is a slight chance of further isolated M-flares. A very slight chance of an isolated X-flare.

Solar Wind / Geomagnetic Activity: A CME may give a glancing impact at Earth sometime on Day 2 (30 Aug), though this is low confidence. There are no other Earth-directed CMEs currently forecast.

Wind speeds are currently at background levels, with only limited enhancement now likely from the forecast CH38/-, and are expected to remain so until the potential CME arrival mentioned

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above. The next impact on the solar winds looks to be coronal hole enhancement which may bring an increase in speeds to slightly elevated levels, 450-500km/s, into Day 4 (01 Sep). Geomagnetic activity is expected to remain generally Quiet. If the CME glance occurs on Day 2 (30 Aug), activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals, with any effects easing into Day 3 (31 Aug) before potential coronal hole influence likely increases activity once again into Day 4 (01 Sep).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at background levels, with just a slight chance of enhancement, mainly should any larger flares occur from AR3413 or AR3415. High energy (greater than 2 MeV) electron flux is expected to persist at mainly background levels, perhaps reaching moderate at the diurnal maxima. The associated 24 hour fluence is expected to remain below the Active level (1e8 integrated pfu).

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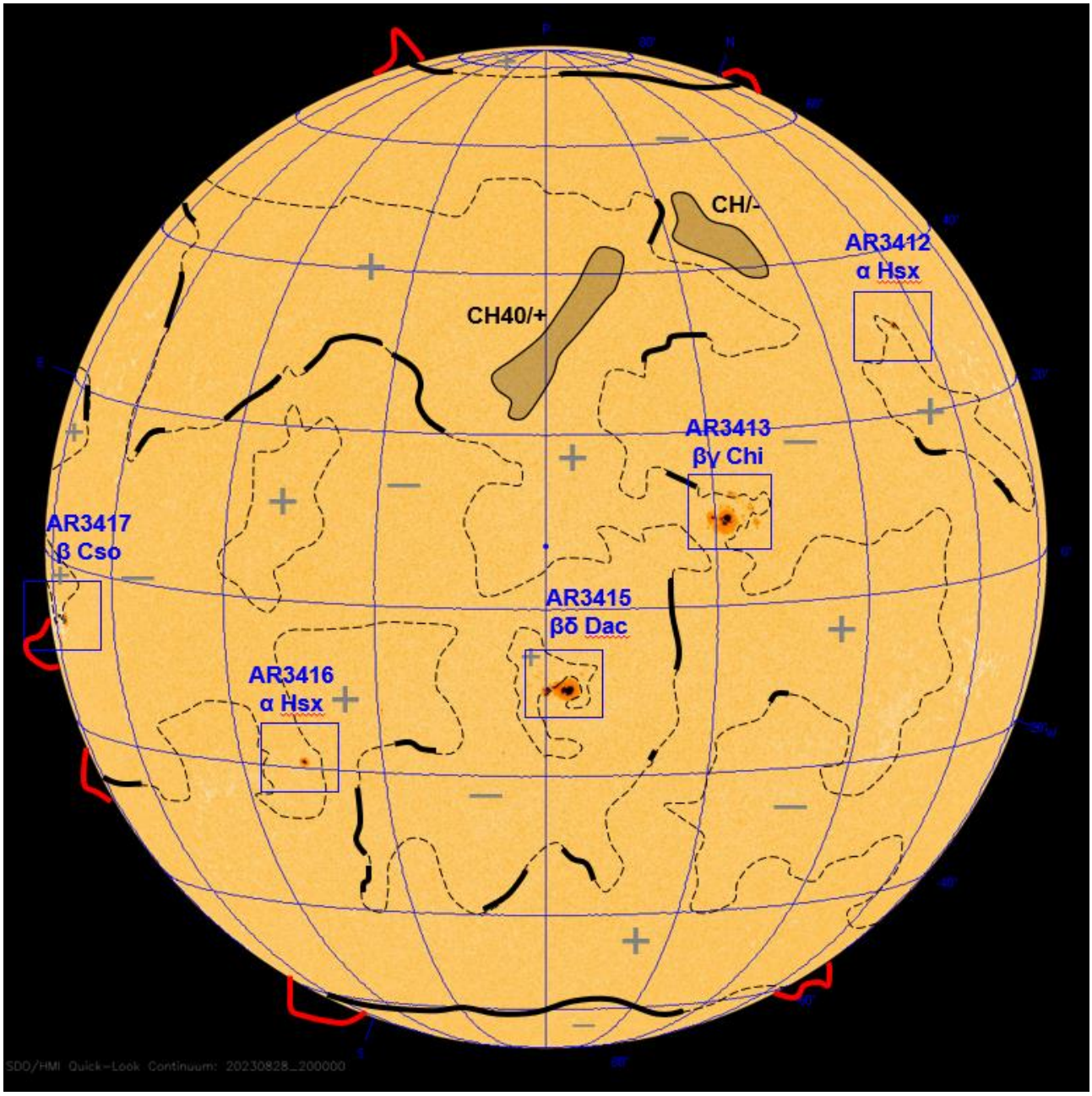
Figure 1. Solar Analysis Valid 28/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The C2.2 flare and associated dimming from AR3413 at 25/1006 UTC likely produced a CME, with a very faint eruption subsequently detected in SOHO imagery. Assessment of this suggests a glancing CME impact is possible at Earth sometime on Day 2 (30 Aug) though this is low confidence. There are no other Earth-directed CMEs currently forecast.
Wind speeds are currently at background levels, with only limited enhancement now seeming likely from the forecast CH38/-, and are expected to remain so until the potential CME arrival mentioned above. The next impact on the solar winds looks to be coronal hole enhancement from two northern hemisphere coronal holes, with particularly recurrent CH40/+ near center disk forecast in Enlil output to bring an increase in speeds to slightly elevated levels, 450-500km/s, into Day 4 (01 Sep).

Geomagnetic activity is expected to remain generally Quiet. If the CME glance occurs on Day 2 (30 Aug), activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals, with any effects easing into Day 3 (31 Aug) before potential coronal hole influence likely increases activity once again into Day 4 (01 Sep).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	20	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
26/1733	Partial	C2.2 flare	W-Centre disc	529 km/s	30/1200 UTC +/- 10 hours	Low confidence.

Figure 2: Latest MOSWOC ENLIL Ensemble output, showing potential CME impact into the 30th and HSS enhancement later into the period. Note however that ENLIL is currently overestimating the likely impact of the expected CH38/-, reducing confidence in the output.

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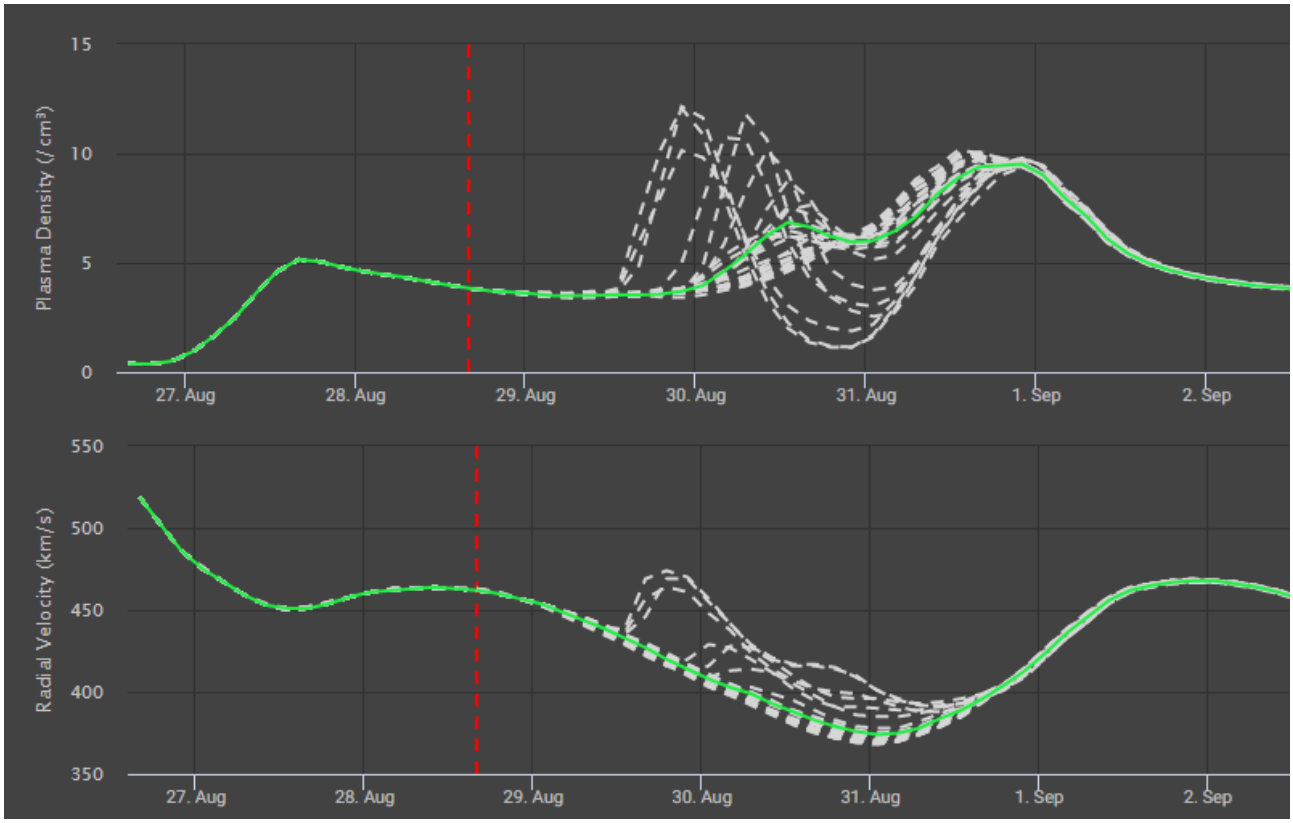

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Radio Blackouts - X-Ray Flares:
The current low activity is expected to generally continue during the forecast period, but there is a slight chance of further isolated M-flares, either from AR3413/AR3415 or perhaps more likely from the new AR3417 region in the far east given this spots history of recent M-flare activity. A very slight chance of an isolated X-flare is maintained given the size and complexity of AR3413 and AR3415, despite the lack of current activity.

There are five sunspot regions on the visible disc. Two of these are small and simple with limited flare risk expected. There are three sunspot groups of interest providing the bulk of flare risk. AR3415 (Dac/Beta-Delta) in the southeast continues with a persistent delta spot configuration, but has remained largely inactive with activity lower than the classification would suggest. The larger AR3413 (Chi/Beta-Gamma) rotating to the west of centre disk has continued to see small amounts of development to its multiple leading spots and retains a north-south magnetic alignment and some low level flaring. The new AR3417 region in the far east gave a long period M-flare on 26 Aug from over the eastern limb, so this region is one to watch with further magnetic looping visible in SDO AIA 171 imagery. All three features remain on the visible disk through the period with no significant oncoming regions expected.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

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Solar Radiation Storms - (High Energy Protons):
High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at background levels with just a slight chance of enhancement. The main risk of any increased proton flux would be from the occurrence of any larger flares from AR3415 or AR3413, with these near centre disc and starting to transit through the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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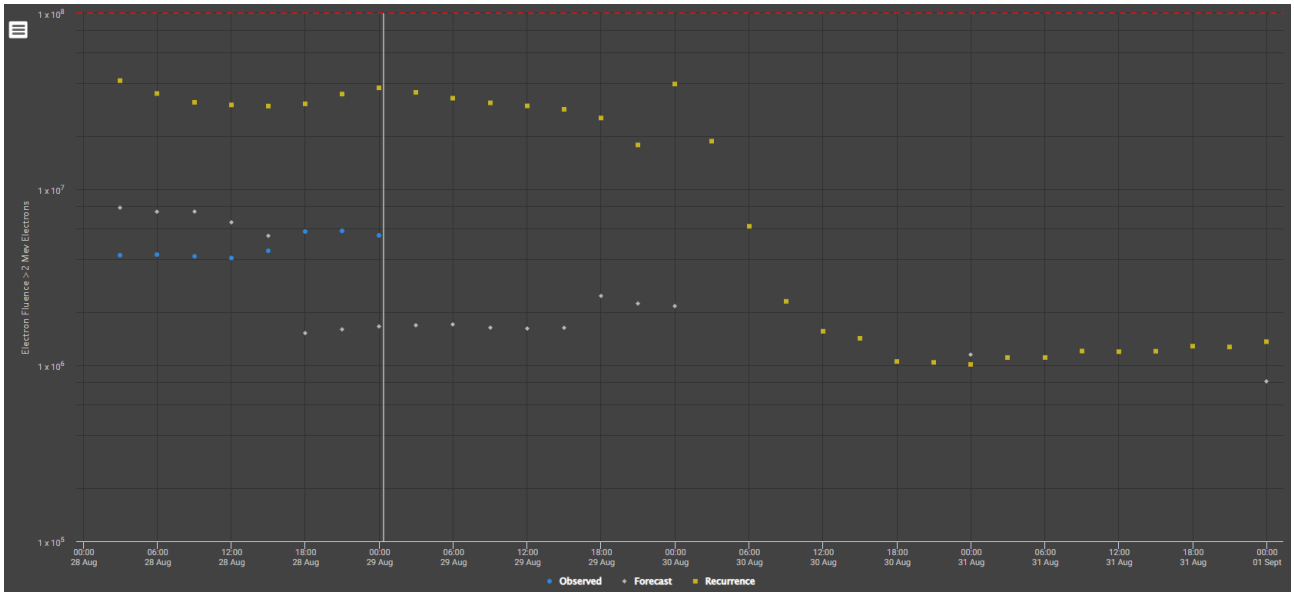
High Energy Electrons Event (≥ 2MeV):
High energy (greater than 2 MeV) electron flux observed by GOES16 is expected to remain at background to moderate levels for much of the period, given a lack of recent electron enhancement. A possible CME glancing blow on Day 2 (30 Aug) and any associated geomagnetic activity could also keep flux levels suppressed.

The associated 24 hour fluence is expected to remain below the Active (1e8 integrated pfu) level, with any rise in fluence likely to be modest. This is supported by REFM, which currently seems to be a reasonable guide.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	5	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: latest MOSWOC REFM model output.



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